Resource Characterization

Prospecting and Solar Resource Analysis

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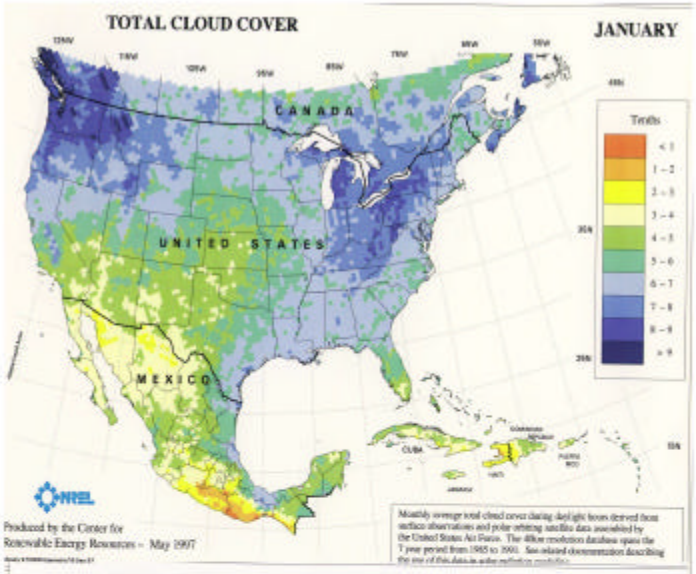
How this activity reduces trough technology costs

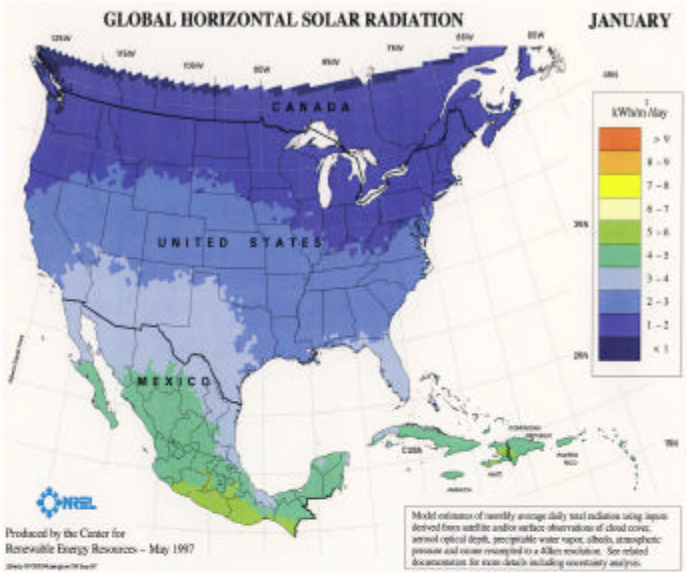
- Shortens timeline to revenue production
- Can lower the cost of debt and equity financing
- Improves system design
- Optimizes energy (and revenue) generation
- Can lower O&M costs

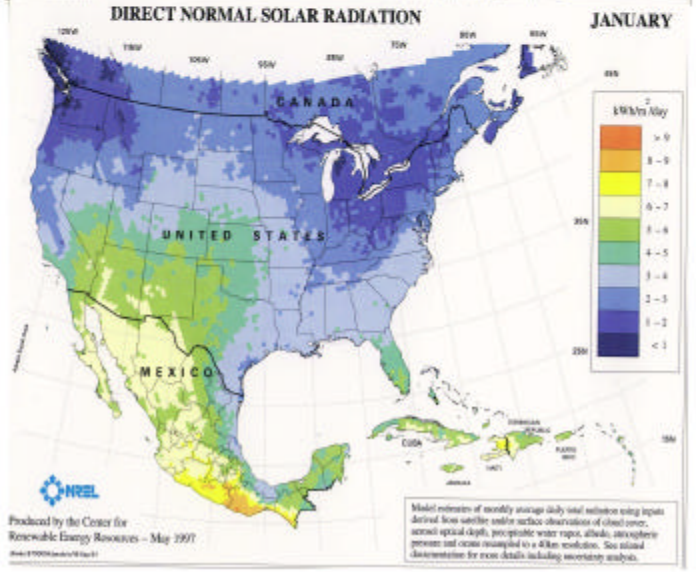
Assisting Market and Project Development:

- Site Prospecting
  - Solar resource mapping
  - Geographic Information Systems (GIS)
- Site Analysis
  - Time series models
  - Measurements/data quality assessment
  - Transient cloud characteristics and forecasts

The Climatological Solar Radiation (CSR) Model







Cloud Cover Data

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Direct Normal Insolation

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Global Horizontal Insolation

The CSR Model is a Prospecting Tool

- Produces solar (dni) maps for large areas on 40-km “data grids” to depict microclimate variability
- Estimates monthly avg. insolation for various collector orientations; e.g. 1-axis tracking concentrators, N-S
- Accounts for cloud cover, haze, water vapor, ozone
- Output readily adaptable to GIS analysis

Geographic Information Systems

- User can overlay resource data with infrastructure data
  - Gas and transmission lines
  - Roads
  - Load centers (population centers)
  - Utility data
  - Land prices/ownership
- Allows calculation of derived parameters in spatial context
  - Cost of Energy
  - Internal Rate of Return
  - Life Cycle Cost Analysis
- Facilitates siting, system design decisions

Improved prospecting tools can be developed:

- 10-km resolution possible with GOES-8, GOES-9, Meteosat satellites (Perez, et al.)

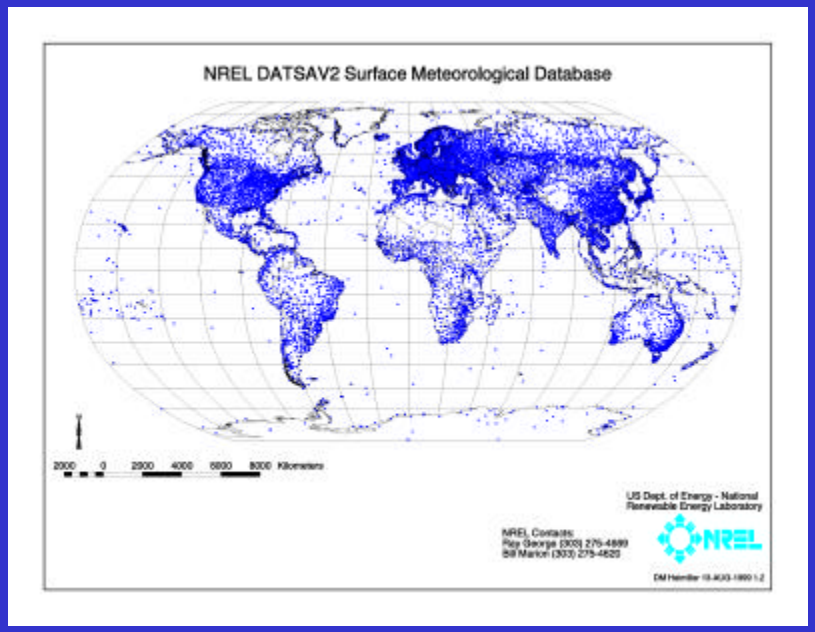
- Data grids can be made more accurate with higher resolution
  - Improvements to haze data
  - Improved satellite-derived cloud data
  - Use of geospatial statistical techniques

- Inclusion of world-wide geospatial data
  - Infrastructure
  - Economic
  - Demographic

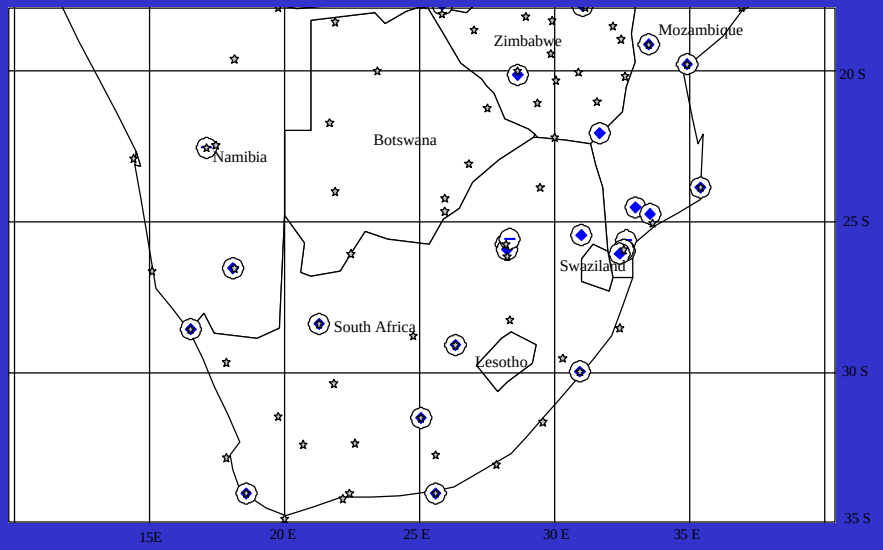
Hourly Dataset Methodology

- Simulate ground-level diurnal insolation from hourly meteorological observations (DATSAV2 dataset)
- About 20,000 stations worldwide
- 25 or more years of data at each site
- Can develop TMY statistics
- Test case completed for Southern Africa (funded by PV program)

Hourly Datasets for Southern Africa



Southern Africa DATSAV2 surface weather stations



DATSAV2 station with over 10 years data

WRDC radiation monitoring station

Site Measurements

- Validates resource estimates; provides model input data

- Various options, depending on application
  - Pyrheliometers
  - Rotating Shadowband Radiometers
  - Multipyranometer Arrays

- Wide hardware cost range per site
  - Research systems: $23-33K
  - Utility applications: $13-23K
  - Prospecting, educational: $3-5K

- Data Quality Assessment tools are available

In-Country Capacity Building

- Development and interpretation of resource maps and data
- Application of GIS-based analyses
- Installation, operation, and maintenance of measurement stations
- Quality assessment of measured data
- Making data accessible to planners and investors

Understanding Transient Cloud Characteristics

- Sub-hourly cloud characteristics influence plant operations
- Similar resource levels can be associated with a variety of cloud conditions
- Forecasting cloud characteristics is of particular interest to plant operations

Possible Next Steps

- Implement prospecting tool improvements and enhancements
  - Data grids: clouds, haze
  - Perez' approach
- Conduct "pilot" case study (or studies)
  - Southern or South Africa
  - Mexico
- Implement site measurements